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THE CUPRIFEROUS SERIES IN MINNESOTA.*

The paper of Prof. N. H. Winchell, State Geologist, of Minnesota, was a brief statement of the relations of that formation to the ranges of crystalline rock that form the northwestern border of the Lake Superior Basin. He concluded, by two lines of investigation, that the Cupriferos series is of the age of the New York Potsdam, and that it falls within the horizon of some part of that group which the Canadian geologists have designated the Quebec.

One line of argument related to an examination in the field of the stratigraphy, in which the sedimentary beds are seen to pass by metamorphic changes through various forms to fully crystalline rocks styled granite and gneiss. These crystalline rocks, which are spread over large areas, are intimately associated with the igneous rocks of the Cupriferos Series, from which, however, they are constantly distinguished by certain mineralogical differences. The writer also parallelized the igneous beds of the northwestern coast ranges with the Labradorite, or Norite, rocks of Canada, and suggested the possibility that the "Laurentian" Eozoon, said to occur in this terrane, may be of the age of the Lower Silurian.

ON COLOR BLINDNESS.*

By DR. B. JOY JEFFRIES.

DR. JEFFRIES first described the natural condition of the color-sense, and illustrated some of its peculiarities relating to color-blindness. The complimentary after-image of a color can be readily seen by gazing at the red setting sun, when, if we turn our eyes to the east, we shall see a *green* rising one. Looking steadily at a yellow spot on white, and turning away, we see a blue one, etc. After looking intently at the red or green light on a railroad or vessel, one cannot help momentarily seeing the reverse color. The centre of the retina has the greatest power of form-perception; we must fix our eye steadily to see anything very distinctly. The same with color. All colors fade in intensity outward from the centre of the retina. In a central zone we can distinguish all three of the colors now considered primary, viz., red, green, and violet. In a zone outside of this our red perception fails, and in the outer portions still of the retina green fails, and we see blue or violet only. Now, we have *red*, *green*, and *violet* blindness, resembling, so to speak, the conditions of these zones. This must not, however, be too strictly construed. Color-blindness may be best described thus: Those who are red or green (one involving the other) or violet-blind see all objects having these colors as gray or grayish in the proportion in which they are color-blind and the depth of the pigment. A color mixed with their faulty one will be, so to speak, *muddy*. Many thousands of examinations have been made all over the world, with the same result. He has tested 17,695 males, finding 739 color-blind in greater or lesser degree, viz., about 4 per cent. In females it is very rare, which, however, their familiarity with the colors does not account for. He tested 13,893 females, finding only ten color-blind. Age, race, color, education, condition of civilization—all seem to have no effect, as tests have been now made from the north pole to the equator, and throughout Europe and America. It is congenital, and largely hereditary. It may be artificially produced by putting a person in a cataleptic or hypnotic state; also those color-blind who can be put in this state can be temporarily relieved of their defect. It may be cured by tobacco and alcohol poisoning, by injuries affecting the head, and by disease. It is a symptom of some brain disease of constitutional origin.

It can be palliated by gas light, or by looking through pale lemon-colored glass, or by looking through a solution of the aniline dye called fuchsine. All this does not cure, but simply changes the relations of light and shade for the color-blind, by which alone they distinguish their faulty colors. The reader briefly described how difficult it was formerly to detect color-blindness, and referred to his manual in explanation of the manner in which persons affected escape. Thanks to recent observers and workers in the field we now have methods which are simple, and readily and quickly carried out by competent experts.

These facts have led the United States Government to undertake its control in the army, navy, and marine hospital service. Unusual examination of seamen is not yet compulsory. Its great value to the sailor was particularly explained. Standard tests and standard powers of sight and color-perceptions are not yet determined by the United States. An International Commission to determine these has been proposed in a bill now before Congress. The future value of such a commission was explained, and the audience urged to assist in having the system carried out.

As to the railroads of the country, Dr. Jeffries quoted from his book, now a United States manual; "The difficulties are very great. Here the interests and the safety of the community have to contend with ignorance, prejudice, pecuniary considerations and incredulity born of supposed immunity from danger." This has proved most true, and even at this date, three years and a half since he, in this same room, called public attention to the danger from color-blindness, but one State, Connecticut, has passed laws controlling color-blindness and visual defects among railroad employes. And here in this State most violent attempts have been made to prevent the action of the law in protecting the community, even politics being introduced.

The practical tests, approved of over the world and recommended at the International Medical Congress at Amsterdam, September, 1879, and directed by the Connecticut Board of Health in charge of the control, were then thoroughly shown and explained. Practical illustration was also given the audience by a color-blind gentleman who kindly consented to exhibit his infirmity in the cause of science. These tests were Holmgren's with the colored worsteds (used by Dr. Jeffries in our public schools and the association), Donders and Daae's modification of this method, Stilling's pseudo-chromatic cards, Woinow's disk, Pfliiger's letters, and finally Donders' method with reflected light and transmitted light, and Holmgren's with colored shadows,—these last two being for the purpose of determining the quantitative color-sense so necessary in deciding the fate of a railroad employé or pilot. The simple, practical use of these methods in the hands of competent experts was shown and proved in testing thereby the color-blind present. Dr. Jeffries explained in detail how theoretical was the attempt to decide the color-sense by lanterns and flags used on land or sea, and how readily mistakes would thus be made. The worsted test can, by competent experts, be quickly made in the paymaster's car, for instance, whereby no man is taken from his duty. The color-blind can thus be sorted out, and subsequently re-examined with these additional tests as a means of control, and to exhibit their precise defect to those in authority. During and after the reading of the paper color-blind gentlemen present were exhibited, to their astonishment and to that of the bystanders. All present were asked if convinced by what was shown of the danger, to exert their influence in the cause of control of color-blindness. Dr. Jeffries stated in conclusion that he had hoped to have been able to touch upon the most interesting point of the development of the color-sense and the education of our color-perception. He was, however, only able to briefly refer to the work going on of the study of color development, and particularly the contributions to it by his friend Dr. Hugo Magnus, of Breslau. Dr. Jeffries' work in testing all the Boston school-children showed, as it has elsewhere, the great ignorance on the part of males of color-names, aside from color-blindness. He exhibited Dr. Magnus' color-chart for teaching children colors and their names, which received a diploma of honor from the International Medical Society at Amsterdam. The use of this he explained, and said he was engaged with Mr. Prang in its introduction into this country among our schools, both private and public. The great purpose of this special work being to teach the child to associate with the word the color and the color sense, as well as the mere color names.

OCURRENCE OF OZONE ON EVAPORATION OF DIFFERENT LIQUIDS.—A few drops of ether or alcohol are let fall upon a paper equally moistened with cadmium iodide-starch solution, and the volatile liquids set on fire. After their co-operation the paper is found to be turned blue from the formation of ozone.—*Polyt. Notizblatt*.

* Read before the A. A. S., Boston, 1880.